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SPRUCE BUDWORM IN A WHITE SPRUCE PLANTATION

by

Robert P. Ford, Entomologist
St. Paul Field Office

INTRODUCTION

An outbreak of spruce budworm (Choristoneura fumiferana (Clemens)) began on the Chequamegon National Forest in Wisconsin in 1979. Budworm attacks on one host tree species, white spruce (Picea glauca (Moench) Voss), is of particular concern to foresters because the trees are in high-value plantations. In July 1979, Larry Mellstrom, Forester, Glidden Ranger District, requested a survey of the budworm situation in a white spruce plantation. This is a report of that survey made by Lynne Whyte in August 1979.

METHODS

The white spruce plantation was established in 1939 on 46 acres located in T42N, R4W, S33. This plantation is situated on the west side of Route GG and on the south side of forest road 323. There are mixed stands of hardwoods and swamp conifers on the poorly drained sites surrounding the plantation.

Fifteen 3-tree clusters were selected for sampling. The clusters were chosen to provide even distribution throughout the plantation. Each cluster consisted of 3 white spruce trees in the dominant or codominant crown classes.

Three 37 cm branch tips were pruned from the midcrown of each sample tree. Defoliation estimates were made for each branch by rating 25 current shoots, starting at the distal end, according to the following:

Percent defoliated	Rating
0-25	1
26-50	2
51-75	3
76-100	4

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The average rating was calculated for the branch; these averages used to arrive at an average defoliation rating for the cluster.

Each pruned branch was examined in the field for spruce budworm egg masses. The egg masses were counted and the average number of egg masses/37 cm branch recorded by cluster. The egg masses were further examined to determine how many were more than 50 percent parasitized.

Eight points, chosen for distribution throughout the plantation, were used to sample stand characteristics including basal area of spruce, tree height, crown condition, and associated tree species. Crown condition was categorized as live, top killed, or dead. Basal area was estimated with the aid of a 10 BAF prism, 5 inches dbh minimum.

RESULTS

Current defoliation of white spruce ranged from 29 to 73 percent and averaged 58 percent (Table 1). Any defoliation greater than 30 percent affects growth rate of the tree, and any defoliation exceeding 60 percent results in deterioration of the tree. Eight of the 45 sample trees (18 percent) were more than 60 percent defoliated. Past defoliation was very light, and the tree crowns were large. This means the tree can withstand several more years of heavy defoliation before top kill occurs. All sample trees were live with no current or past top kill.

Spruce budworm egg masses, 2.2/37 cm branch, indicated a heavy budworm attack in 1980 that may result in 40 to 60 percent defoliation of new growth. Parasitism of the egg masses was insignificant, 6 percent. This is much lower than the expected 12 percent usually associated with spruce budworm outbreaks.

Trees in this 40-year-old plantation were about 44 feet tall. There were nearly 200 ft^2 of basal area/acre in white spruce with an unmeasured (but estimated at about 7 ft^2) basal area of associated tree species. Balsam fir was the usual associate in the clusters; and these trees are principal hosts of the spruce budworm.

RECOMMENDATIONS AND DISCUSSION

We recommend that foresters apply standard guides for thinning white spruce in this plantation. The thinning will have several positive effects in management of the budworm outbreak: 1) increase the vigor of the residual stand to offset defoliation by budworm, 2) increase loss of dispersing young budworm larvae, and 3) eliminate balsam fir. Simmons (1979) has established a demonstration area on the Upper Pennisula of Michigan to show how thinnings minimize spruce budworm damage.

Thinning should leave hardwoods in the plantation if they are not interfering with growth of the spruce. These hardwoods reduce the dispersal success of budworm larvae (Batzer 1974).

New shoots of white spruce continue to grow for about a week after budworm larvae have stopped feeding. This new growth, distributed over a tree having a large live crown ratio, is sufficient to keep white spruce alive, though large crowns contribute to survival of late instar larvae. Opening a stand by thinning can increase shoot length by 40 percent (Greenbank 1963), thus helping to maintain tree vigor through a budworm attack.

Vigorous trees will be needed after budworm attacks subside to reduce chances of attacks by bark beetles, particularly the spruce beetle (Dendroctonus rufipennis (Kirby)). These insects, and Ips perturbatus Eichhoff, were responsible for an estimated 54 percent of white spruce mortality in a stand in Ontario that had been defoliated by spruce budworm (Thomas 1958). In most instances, less vigorous trees larger than 12 inches dbh were killed by the beetles. Baker (1972) suggests that the spruce beetle may be controlled somewhat by cutting infested trees in the fall and removing logs before spring.

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Table 1.--Spruce budworm egg mass and defoliation estimates on white spruce, Glidden Ranger District, Chequamegon National Forest, 1979

Cluster number	Defoliation (percent)	No. egg masses/37=cm branch	
		Hatched	Parisitized
1	71	4.2	0.3
2	58	2.0	0.0
3	54	1.2	0.2
4	73	4.0	0.5
5	58	0.8	0.2
6	69	1.8	0.2
7	69	1.8	0.0
8	29	0.5	0.0
9	54	3.5	0.2
10	48	3.2	0.0
11	50	1.5	0.0
12	59	2.2	0.2
13	61	2.3	0.2
14	67	3.0	0.0
15	54	1.3	0.3
Mean	58	2.2	0.15